Statistics Research Project

Project Description

In this open-ended Statistics project, each student will have the opportunity to **collect data** and **analyze the data** by constructing one or more confidence intervals (and/or p-values). The project aims to provide students with a hands-on experience in applying statistical concepts and techniques to real-life situations.

Students will be encouraged to choose a topic of interest that allows them to incorporate something they enjoy into their project. For example, they could investigate the probability of making a free throw by shooting 100 free throws, or explore whether singing to seedlings influences their growth rate.

The project will consist of the following components:

- Data Collection: Each student will collect their own data by conducting experiments or surveys related to their chosen topic. The methodology should be carefully considered and reported.
- Data Analysis: Using the collected data, students will calculate one or more confidence intervals that indicate estimates (and uncertainties) of parameters (such as a probability or a population mean). For more advanced projects, a significance test's p-value can be reported instead of a confidence interval.
- Interpretation: Students will interpret their confidence intervals (or p-values) in the context of their chosen topic. They should explain what the confidence intervals represent, what the confidence level indicates, and any potential limitations or assumptions of their analysis.
- Report: Each student will present their findings as a paper, in-class presentation, or video. Reports should be clear, concise, and engaging, and should effectively communicate the main ideas, methodology, and results of the project.

Parts of a research report

Below is a rough guide to a standard research report.

- Abstract
    - The abstract is a overview of the whole report. It summarizes everything in a single paragraph. I recommend writing the abstract last, but placing it in the beginning of the report.

- Background
    - Why did you pick this research topic?
    - Why should other people find this interesting?
    - What other work have people done on this topic or similar topics?

- Methods
    - As precisely as possible, describe how you collected the data.
    - How did you try to minimize bias in your sampling method?
    - How did you randomly assign participants while keeping them blind to their treatment?

- Analysis
    - How did you analyze the data?

- – What equations did you use?
    - – What confidence intervals or p-values did you calculate?

- Discussion

    - – How should we interpret your analysis?
    - – What are some possible sources of bias?
    - – What new questions occurred to you during this research that someone else might explore?

- Bibliography

    - – If you cited other work, please list the citations in a consistent manner.

Grading rubric

Criteria	Points
State your research question and why it's interesting.	5
Clearly explain the methodology used to collect data.	5
Provide a link to the raw data (probably stored in a shared google sheet).	2
Consider the potential for bias in the sample, and attempt to minimize it.	3
Calculate appropriate sample statistics (some possibilities: n, $\hat{p}$, $\bar{x}$, s)	5
Accurately calculate confidence intervals or p-values; show formulas.	5
Interpret the meaning of the confidence intervals or p-values for your context.	5
Present findings in a clear, concise, and engaging manner	5
Show creativity and originality in the approach and presentation of the project	5